MONITORING REPORT FORM (CDM-MR)
Version 01 - in effect as of: 28/09/2010

CONTENTS

MONITORING REPORT
Version number:01 and date 11/03/2011
"Forced Methane extraction from Organic wastewater", at Mandya District, Karnataka by M/s Sri Chamundeswari Sugars Ltd.
Reference number:1088
Second monitoring period
Monitoring period: 01/01/2009 - 31/12/2010 (first and last days included)

SECTION A. General description of the project activity

A.1. Brief description of the project activity: >>

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Purpose of the project activity

The main purpose of the project activity is the installation of a closed anaerobic digestion system to extract methane rich biogas from organic wastewater generated at the distillery of Sri Chamundeswari Sugars Ltd. The biogas is collected and utilized as fuel in boilers to produce steam and the steam is utilized to produce electricity. The organic wastewater from distillery also known as spentwash is diverted from existing open anaerobic lagoon treatment system into closed anaerobic reactors to recover methane rich biogas and utilise the methane as fuel to generate steam and electricity. The emission reductions due to recovery of methane alone are considered as emission reductions of the project activity.

The project activity involves the installation of a closed anaerobic digestion system to treat the spent wash from the distillation process instead of the open lagoon system (baseline scenario), thereby avoiding the release of methane to the atmosphere.

The project activity reduces greenhouse gas emissions in two ways :

i. The project activity diverts the organic wastewater from existing open anaerobic lagoon treatment system to closed anaerobic treatment system thereby preventing the release of methane, a GHG, into the atmosphere.

ii. The generated methane rich biogas is utilised as fuel to generate heat and electricity, which displaces electricity consumed from on site diesel fired generator and grid; thereby reducing the GHG emissions associated with diesel firing and grid electricity generation.

The Project has been completed as planned and described in the Project Design Document (PDD). The first digester was commissioned on 04th March 2005 whereas the second digester was commissioned on 25th June 2005.

The project activity has applied approved small scale methodology AMS-III.H- 'Methane recovery in wastewater treatment' version 4 and the total emission reductions achieved in this monitoring period is **28,333.0 tCO2e**.

A.2. Project Participants

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Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants(as applicable)	Kindly indicate if the Party involved wishes to be considered as project

		participant (Yes/No)
India (Host)	Sri Chamundeswari Sugars Limited (SCSL) - (Private entity)	No
Switzerland	Bunge Emissions Fund Limited (Private entity)	No

A.3. Location of the project activity:

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The project activity is located within the premises of Sri Chamundeswari Sugars Ltd (SCSL) in Bharathinagara in KM Doddi village in Maddur Taluk in Mandya district in Karnataka state in India.
The physical coordinates of the project activity are : 12º 23'N and 77º 01'N

A.4. Technical description of the project

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The anaerobic digestion plant is designed to handle 600 m^3/day of wastewater with a COD of 150 kg/m^3 and BOD of 50 kg/ m^3. The wastewater treatment can be broadly divided into following sections:

i. Pre-treatment
ii. Biomethanation
iii. Utilization of biogas
iv. Post –treatment

i) Pre-treatment
The organic wastewater discharged from the distillery is collected in a holding pit. From holding pit, it is pumped to a settling tank where settlable solids present in the wastewater settles and is removed. The overflow from settling tank flows to a buffer tank. The volume of the buffer tank is 300 m^3, sufficient to hold two-thirds of daily discharge. The pH of the wastewater is in the range of 5-5.5. Lime solution is added to raise the pH of wastewater to 6.5 for effective degradation of organics. Microbial activity is at optimum when the pH of the substrate is in the range of 6.5 - 8. Nutrients like urea, di ammonium phosphate and micronutrients like ferric chloride are added in the buffer tank, if required, to supplement the nutrient requirement.

ii) Biomethanation
The wastewater is then subjected to anaerobic treatment in closed anaerobic reactors. Upflow anaerobic Sludge Blanket (UASB) type of anaerobic reactors is employed in the project activity. The wastewater from buffer tank is pumped to UASB reactors. Two UASB reactors each of 26 meters diameter and 9.5 meters height are provided for anaerobic digestion. The effective liquid height in UASB reactors is 9 meters and therefore effective liquid volume is 4780 cubic meters in each UASB reactor. The wastewater enters the reactors from the bottom of the reactor through a distribution pipeline grid. Holes are provided in the distribution pipeline and when wastewater is pumped in the pipeline, the effluent enters the reactors through these holes uniformly. The wastewater flows in an upward direction in the digesters through an anaerobic sludge bed where it mixes with micro organisms in the sludge bed.

The treatment of wastewater through anaerobic treatment involves following three step process:
i) Hydrolysis
ii) Acidogenesis
iii) Methanogenesis.

The process of hydrolysis takes place in buffer tank, which is the preparatory step for acidogenesis and

methanogenesis reactions. Acidogenesis and methanogenesis take place in digesters. Acidogenesis reactions break the complex organics in the wastewater into acids and these acids are further destroyed into basic compounds of methane (CH_4) and carbon dioxide (CO_2,) the mixture of which is known as biogas. Temperature is one of the main parameters for effective degradation of the organics. The anaerobic reactions occur when the digester temperatures are above 25° centigrade (C) and are at optimum at still higher temperatures in the range of 30–37°C. The temperature of the UASB contents is always between 30-37°C and thus anaerobic reactions are at optimum levels. The high ambient temperatures present in southern part of India throughout the year ensure maintenance of desired range of temperatures in UASB reactors without the need for any external heating. The resulting anaerobic degradation produces biogas. Biogas is a mixture of CH_4 and CO_2. Biogas produced rises upward through the sludge along with the wastewater. At the top of the reactor, the water phase is separated from solids and gas in a three phase separator (also known as gas –liquid -solid separators - GLSS). The three phases are gas is biogas, liquid is treated wastewater and solid is the sludge in the wastewater. Gas is collected separately, subjected to water cleaning in gas washer system and buffered in a gasholder before being used as fuel. The liquid, that is, the treated wastewater, overflows to a 'treated wastewater collection tank' and solids in the liquid slide down into the UASB reactor. The biogas is drawn and transferred by booster blowers to the existing cogeneration system.

iii). Utilization of biogas
The biogas is burnt as fuel in boilers along with bagasse in existing cogeneration system to produce steam. The steam is utilized in turbines to produce electricity.

A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

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Methodology applied is AMS-III.H - Methane recovery in wastewater treatment, version 4

A.6. Registration date of the project activity:

>>
27/07/2007

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

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Crediting period: 27 /07/2007 - 26 /07/20 17 (Fixed)
Start date of project activity: 01/06/2005

A.8. Name of responsible person(s)/entity(ies):

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Organization:	Sri Chamundeswari Sugars Ltd
Street/P.O.Box:	76, Ulsoor Road
Building:	-
City:	Bangalore
State/Region:	Karnataka
Postcode/ZIP:	560042
Country:	India
Telephone:	+91 80 25588033
FAX:	+91 80 25586119
E-Mail:	ho.projects@chamundisugars.com
URL:	--
Represented by:	
Title:	Managing Director

Salutation:	Mr.
Last Name:	Mahalingam
Middle Name:	
First Name:	Srinivaasan
Department:	--
Mobile:	
Direct FAX:	+91 80 25586119
Direct tel:	--
Personal E-Mail:	msrini66@yahoo.com

SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity

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The first digester commissioned on 04th March 2005 whereas the second digester was commissioned on 25th June 2005. During this verification period, there was less biogas generation due to less wastewater generation. The wastewater generation was less as the distillery unit experienced shut downs in April 2009, May 2009, August 2009 and September 2009.

B.2. Revision of the monitoring plan

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The monitoring plan has been revised which was approved by UNFCCC on 21/07/2010[1].

B.3. Request for deviation applied to this monitoring period

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Deviation from registered PDD and monitoring methodology with regards to measurement of parameters to be monitored has been applied to this monitoring period which has been accepted by UNFCCC[2] .

The deviation has been applied as volume of biogas generated ($Q_{y, biogas, generated}$) was not monitored during the monitoring period. Thus, the volume of biogas generated is reported as a sum of measured values of biogas sent to boiler ($Q_{y, biogas, sent\ to\ boiler}$) and biogas flared ($Q_{y, biogas,flared}$).

The deviation was accepted during the last monitoring period, including the period between 1st January 2009 to 26th January 2009 i.e upto the date of installation of meter.

B.4. Notification or request of approval of changes

>>Project proponent has not applied for notification or request of approval of changes from the project activity as described in the registered CDM-PDD.

SECTION C. Description of the monitoring system

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The project activity is located in the premises of sugar mill and distillery complex. Senior General Manager is the overall head of operations of the complex. The Senior General Manager is in charge of operations of the wastewater treatment plant including methane recovery system and other facilities in the wastewater treatment plant.

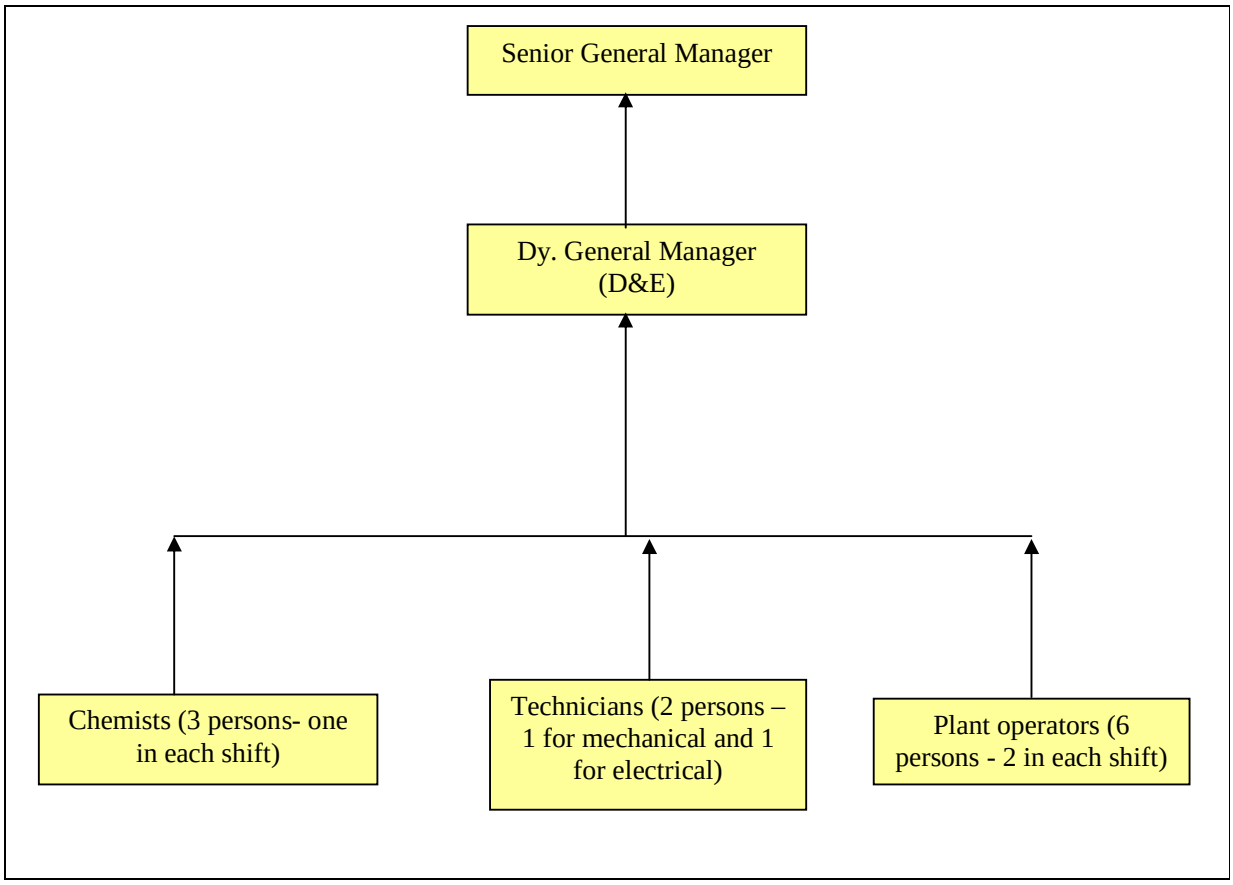
[1] http://cdm.unfccc.int/filestorage/950NK3G4AJ7CSFRBYETZDW68OILU2Q/1088%20revised%20MP%20clean.pdf?t=WGJ8MTI5NzI0OTU5OS44|b23Tc046xU0J135PXn1T6GWHkBI

[2] http://cdm.unfccc.int/Projects/deviations/31696

The plant operators run the plant on a day today basis and are assisted by two technicians for maintenance of mechanical and electrical installations in the plant. A chemist with graduate/postgraduate qualification in chemistry are available in each shift for analysis of all operating parameters like COD, biogas, etc,

The technicians are responsible for maintenance of equipment and installations in the anaerobic digestion plant. Any break down is recorded with details like type of break down, trouble shooting done, etc., and verified by the Dy. General Manager (D&E).

The organization structure illustrated below is in charge of the operation and maintenance of the wastewater treatment plant.



Data monitoring

Records are maintained for quantity of waste water entering the digesters/day, its COD, gas flowing to heating equipment, gas to flare etc.. All these records are verified by Dy. General Manager (D&E) and after verification and approval are maintained in electronic form as per monitoring methodology. The records are maintained in office cum laboratory of the anaerobic digestion plant. A back up is created in electronic form for all the records and maintained for two years after last issuance of CERs. The monitoring parameters like COD of wastewater entering digesters, COD of wastewater leaving the digesters, flow of wastewater entering digesters, methane content of biogas etc., are measured and recorded by the chemists. These parameters are checked by Dy. General Manager (D&E). After approval by the Dy. General Manager (D&E) these values shall be maintained in electronic form till two years after the last issuance of CERs.

QA/QC procedures

All instruments like wastewater flow meter, gas flowmeter, temperature and pressure measuring instruments, Gas analyser are calibrated as per manufacturers' recommendations. The flowmeters are calibrated as per international/ manufacturers' recommendations or atleast once in a year.

Internal Audits

All reported results and measurements are periodically reviewed by Senior General Manager and any discrepancy are corrected with authorization from Senior General Manager.

Emergency

The project activity does not have any operation that would result emergency emissions. Hence, there is no data monitored for emergency preparedness.

UEPL shall train the SCSL staff in all emergency requirements. The staff shall be trained in operation and maintenance of fire fighting equipments like fire extinguishers. The emergencies can be leakage of biogas from gas holders, other gas handling equipment like gas cleaning system, gas blowers. Although all the equipment, piping and instrumentation are as per explosion proof and gas tight, emergencies can happen. The staff has been trained to feel such leakages and immediately rectify the leakage areas.

The quantity of biogas that is generated, sent to boiler and flared shall be continuously measured by flow meters and recorded. From this data total biogas generated in the year "y", is calculated, which will be $Q_{y, biogas.}$

The methane content of biogas in percentage shall be measured once in a month and average value shall be adopted and this value would be $C_{CH4.}$

The emission reductions ER_y would be given by the following formula:

$ER_y = BE_y - PE_y$

BE_y	=	$Q_{y, biogas, generated}$	*	C_{CH4}	*	D_{CH4}	*	GWP_CH_4
(tCO_2e)		Nm^3		%		ton/m^3		21 $tCO_2e/t\ CH_4$

The project emissions (PE_y) shall be calculated as described in the section B.6.1. and deducted from emission reductions to calculate the emission reductions of the project activity.

While calculating the project emissions due to inefficiencies of the capture and flare, a default value of 0.5 shall be used when the biogas is combusted in the open flare. When biogas is combusted in the heating equipment, a default value of 1.0 shall be used for the reason that, in the project activity the biogas is combusted along with bagasse in the boilers where all the biogas would combust and efficiency would be 100 %. All the biogas generated in the project activity would be consumed in the heat generating equipment. However during maintenance of heat generating equipment or exigencies, there may be occasions when flare is used to combust the biogas. The number of hours of operation of flare shall be monitored as H_{flare} and the quantity of biogas flared shall be obtained by measuring the volume of biogas flared.

Regular maintenance of the flare would be ensured as per manufacturer recommendation.

Sludge from UASB digesters

The final sludge from UASB digesters is drained periodically from the digesters. Since sludge is there inside UASB digesters for sufficiently long time, it would have completely digested and would not decay any further. This sludge could be directly used for soil application. However, to avoid any minor decay that may happen due to the sludge, this sludge is mixed with pressmud and composted aerobically. Since the sludge is aerobically composted, anaerobic decay would not happen. The quantity of sludge generated and disposed in compost yard would be monitored.

Line diagrams, showing all relevant monitoring points, is enclosed as annex-1 to this report.

SECTION D. Data and parameters

D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

Data / Parameter:	**$Q_{y, ww,}$**
Data unit:	m_3/ year
Description:	Amount of wastewater entering the wastewater treatment plant (anaerobic lagoons in the baseline scenario and into the digesters in the project scenario)
Source of data used:	Operating records
Value(s) :	1,48,500 m^3/year.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions
Additional comment:	-

Data / Parameter:	**COD $_{y, ww, untreated}$**
Data unit:	ton/m^3
Description:	Chemical Oxygen Demand of the untreated wastewater
Source of data used:	Maintenance Records
Value(s) :	0.145
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions, Project emissions
Additional comment:	-

Data / Parameter:	**$B_{o, ww}$**
Data unit:	ton CH_4/ ton CO_2
Description:	Methane producing capacity of the wastewater
Source of data used:	IPCC default value and AMS-III.H/version 4
Value(s) :	0.21
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions, Project emissions

Additional comment:	-

Data / Parameter:	**MCF ww, treatment**
Data unit:	Fraction
Description:	Methane correction factor
Source of data used:	Default values from Chapter 6 of Volume 5, Waste, IPCC 2006 guidelines and AMS-III.H/version 4
Value(s) :	0.8
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions
Additional comment:	-

Data / Parameter:	**GWP_CH4**
Data unit:	ton CO_2 e / ton CH_4
Description:	Global Warming Potential of methane
Source of data used:	IPCC default value
Value(s) :	21
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions, Project emissions
Additional comment:	-

Data / Parameter:	**E y, consumed**
Data unit:	MWh/year
Description:	Electricity consumed per year
Source of data used:	Based on calculations of the power installed in the wastewater treatment plant
Value(s) :	512. 825
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emissions
Additional comment:	-

Data / Parameter:	**EF_y**
Data unit:	ton CO_2/ MWh
Description:	Electricity baseline emission factor of the grid
Source of data used:	Website of Central Electricity Authority. www.cea.nic.in
Value(s) :	0.86
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emissions
Additional comment:	-

Data / Parameter:	**$COD_{y, ww, treated}$**
Data unit:	ton/m^3
Description:	Chemical Oxygen Demand of the treated wastewater leaving the digesters
Source of data used:	Maintenance Records
Value(s) :	0.0435
Indicate what the data are	Project emissions

used for (Baseline/ Project/ Leakage emission calculations)	
Additional comment:	-

Data / Parameter:	**$MCF_{ww, final}$ / $MCF_{ww, treatment}$**
Data unit:	Fraction
Description:	Methane correction factor
Source of data used:	Default values from Chapter 6 of Volume 5, Waste, IPCC 2006 guidelines and AMS-III.H/version 4
Value(s) :	1.0
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emissions
Additional comment:	-

Data / Parameter:	**$CH_{4, y, ww, treated}$**
Data unit:	Tons/ m^3
Description:	Dissolved methane in wastewater
Source of data used:	Default value as per AMS-III.H/version 4
Value(s) :	$10e^{-4}$
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emissions
Additional comment:	

Data / Parameter:	**Depth**
Data unit:	**m**
Description:	Depth of existing lagoons
Source of data used:	Actual measurement at site
Value(s) :	More than 2 metres
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	-
Additional comment:	-

D.2. Data and parameters monitored

Data / Parameter:	**$Q_{y, ww,}$**
Data unit:	m^3
Description:	Volume of wastewater entering the wastewater treatment plant
Measured /Calculated /Default:	Measured
Source of data:	Log books
Value(s) of monitored parameter:	1,70,578
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emissions
Monitoring equipment (type, accuracy class, serial	Make : Manas Microsystems Serial Number : 3071205

number, calibration frequency, date of last calibration, validity)	Calibration Frequency : Once in an year Date of last calibration : 15/03/2010 Validity : 14/03/2011 Date of previous calibration: 18/03/2009 Validity : 17/03/2010 Date of previous calibration: 28/03/2008 Validity : 27/03/2009
Measuring/ Reading/ Recording frequency:	Continuous
Calculation method (if applicable):	NA
QA/QC procedures applied:	Flow meters would be calibrated as per manufacturer's prescribed standards which is once in a year.

Data / Parameter:	**COD y, ww, untreated**
Data unit:	ton/m^3
Description:	Chemical Oxygen Demand of the untreated wastewater
Measured /Calculated /Default:	Measured
Source of data:	Actual measurements in the in-house lab.
Value(s) of monitored parameter:	Please refer to spreadsheet for monthly values.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	NA
Measuring/ Reading/ Recording frequency:	Daily. Average monthly values would be adopted for estimation of emissions.
Calculation method (if applicable):	NA
QA/QC procedures applied:	COD of the untreated wastewater would be analysed in external accredited laboratories once in a month. In case of any major variation between the in-house and external laboratory value, the conservative among them would be considered.

Data / Parameter:	**COD y, ww, treated**
Data unit:	ton/m^3
Description:	Chemical Oxygen Demand of of the wastewater leaving the digesters/ entering lagoons
Measured /Calculated /Default:	Measured
Source of data:	Actual measurements in the in-house lab.
Value(s) of monitored parameter:	Please refer to spreadsheet for monthly values.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emissions
Monitoring equipment (type,	NA

accuracy class, serial number, calibration frequency, date of last calibration, validity)	
Measuring/ Reading/ Recording frequency:	Daily. Average monthly values would be adopted for estimation of emissions.
Calculation method (if applicable):	NA
QA/QC procedures applied:	COD of the untreated wastewater would be analysed in external accredited laboratories once in a month. In case of any major variation between the in-house and external laboratory value, the conservative among them would be considered.

Data / Parameter:	**$E_{y, consumed}$**
Data unit:	MWh/day
Description:	Electricity consumed per day
Measured /Calculated /Default:	Measured
Source of data:	Actual measurement
Value(s) of monitored parameter:	327.709 Please refer to spread sheet for monthly values.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Make : L & T Accuracy Class : 1.0 Serial Number : 0470977 Calibration Frequency : Once in an year Date of last calibration : 20/08/2009 Validity : 19/08/2010 Date of previous calibration: 26/08/2008 Validity : 25/08/2009 Meter Replacement Details: Make : HPL.Socomec Accuracy Class : 1.0 Serial Number : 1K017089 Calibration Frequency : Once in an year Date of meter replacement : 30/12/2009 Due date of meter calibration: 29/12/2010 Date of last calibration : 21/10/2010 Validity : 20/10/2011
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	NA
QA/QC procedures applied:	Electricity meters would be calibrated as per standards.

Data / Parameter:	**$MCF_{ww, final}$ / $MCF_{ww, treatment}$**
Data unit:	Fraction
Description:	Methane correction factor
Measured /Calculated /Default:	Default value

Source of data:	Default values from Chapter 6 of Volume 5, Waste, IPCC 2006 guidelines and Table III.H.1 of AMS-III.H/version 4
Value(s) of monitored parameter:	1.0
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	NA
Measuring/ Reading/ Recording frequency:	NA
Calculation method (if applicable):	NA
QA/QC procedures applied:	NA

Data / Parameter:	**$CH_{4, y, ww, treated}$**
Data unit:	Tons/ m^3
Description:	Dissolved methane in wastewater leaving the reactors
Measured /Calculated /Default:	Default
Source of data:	Default value as per AMS-III.H/version 4
Value(s) of monitored parameter:	$10e^{-4}$
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	NA
Measuring/ Reading/ Recording frequency:	NA
Calculation method (if applicable):	NA
QA/QC procedures applied:	NA

Data / Parameter:	**$Q_{y, biogas, generated}$**
Data unit:	Nm^3
Description:	Volume of biogas generated
Measured /Calculated /Default:	Measured
Source of data:	Log books
Value(s) of monitored parameter:	**64,86,833** Please refer to spread sheet for monthly values
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	-
Monitoring equipment (type, accuracy class, serial	Make : Manas Microsystems Serial Number : 11090459M

number, calibration frequency, date of last calibration, validity)	Calibration Frequency : Once in an year Date of last calibration : 24/01/2010 Validity : 23/01/2011 Date of commissioning : 26/01/2009 Validity : 25/01/2010
Measuring/ Reading/ Recording frequency:	Continuous
Calculation method (if applicable):	NA
QA/QC procedures applied:	Flow meters would be calibrated as per manufacturer's recommendations or atleast once in a year.

Data / Parameter:	**$Q_{y, biogas, sent}$ to boiler**
Data unit:	Nm^3
Description:	Volume of biogas sent to boiler
Measured /Calculated /Default:	Measured
Source of data:	Log books
Value(s) of monitored parameter:	61,09,369
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions, Project emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Make : Manas Microsystems Serial Number : 06040142A Calibration Frequency : Once in an year Date of last calibration : 15 /03/2010 Validity : 14 /03/2011 Date of previous calibration: 18 /03/2009 Validity : 17 /03/2010 Date of previous calibration: 28/03/2008 Validity : 27/03/2009
Measuring/ Reading/ Recording frequency:	Continuous
Calculation method (if applicable):	NA
QA/QC procedures applied:	Flow meters would be calibrated as per manufacturer's recommendations or atleast once in a year.

Data / Parameter:	**$Q_{y, biogas, flared}$**
Data unit:	Nm^3
Description:	Volume of biogas flared
Measured /Calculated /Default:	Measured
Source of data:	Log books
Value(s) of monitored parameter:	301156
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions, Project emissions
Monitoring equipment (type, accuracy class, serial number, calibration	Make : Manas Microsystems Serial Number : 3071206H Calibration Frequency : Once in an year

frequency, date of last calibration, validity)	Date of last calibration : 15 /03/2010 Validity : 14/03/2011 Date of previous calibration: 18 /03/2009 Validity : 17 /03/2010 Date of previous calibration: 28/03/2008 Validity : 27/03/2009
Measuring/ Reading/ Recording frequency:	Continuous
Calculation method (if applicable):	NA
QA/QC procedures applied:	Flow meters would be calibrated as per manufacturer's recommendations or atleast once in a year.

Data / Parameter:	**C_{CH4}**
Data unit:	**%**
Description:	Methane content in the biogas
Measured /Calculated /Default:	Measured
Source of data:	Actual measurement
Value(s) of monitored parameter:	Refer spreadsheet for multiple values
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions, Project emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	NA
Measuring/ Reading/ Recording frequency:	The methane content of the biogas would be measured once in a month by internationally accepted methods. Average value would be used for estimation of methane content and baseline emissions.
Calculation method (if applicable):	NA
QA/QC procedures applied:	Analysis by external laboratory.

Data / Parameter:	**D_{CH4}**
Data unit:	Tons/ m^3
Description:	Density of methane
Measured /Calculated /Default:	Default
Source of data:	Default value as given in ACM0001"Consolidated baseline and onitoring methodology for landfill gas project activities"
Value(s) of monitored parameter:	0.0007168
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emissions, Project emissions
Monitoring equipment (type,	NA

accuracy class, serial number, calibration frequency, date of last calibration, validity)	
Measuring/ Reading/ Recording frequency:	NA
Calculation method (if applicable):	NA
QA/QC procedures applied:	NA

Data / Parameter:	**T_{flare}**
Data unit:	**˚C**
Description:	Temperature of the flare
Measured /Calculated /Default:	Measured
Source of data:	Actual measurement
Value(s) of monitored parameter:	Refer to spreadsheet for multiple values
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	-
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Thermocouple Make : Heatcon Sensors (P) Ltd. Serial Number : 669 Calibration Frequency : Once in an year Date of last calibration : 21/02/2010 Validity : 20/02/2011 Date of previous calibration: 22 /02/2009 Validity : 21 /02/2010
Measuring/ Reading/ Recording frequency:	Measured
Calculation method (if applicable):	-
QA/QC procedures applied:	Calibration as per manufacturer's recommendations or at least once in every three years.

Data / Parameter:	**H_{flare}**
Data unit:	Hours
Description:	Number of hours of operation of flare
Measured /Calculated /Default:	Measured
Source of data:	Log books
Value(s) of monitored parameter:	Please refer to spreadsheet for values
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	NA
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last	NA

calibration, validity)	
Measuring/ Reading/ Recording frequency:	NA
Calculation method (if applicable):	NA
QA/QC procedures applied:	NA

Data / Parameter:	**$S_{y,\ generated}$**
Data unit:	tonnes
Description:	Quantity of final sludge from UASB reactors
Measured /Calculated /Default:	Measured
Source of data:	Log books
Value(s) of monitored parameter:	1891
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Weighbridge Make : Avery Serial Number : EB-03w/124 Calibration Frequency : Once in an year Date of last calibration : 17.06.2010 Validity : 16.06.2011 Date of previous calibration: 18.06.2009 Validity : 17.06.2010
Measuring/ Reading/ Recording frequency:	as and when generated
Calculation method (if applicable):	NA
QA/QC procedures applied:	Calibration of weighbridge been conducted once in a year by the Weight and Measurement Department of Government of Karnataka.

Data / Parameter:	**$S_{y,\ composted}$**
Data unit:	tonnes
Description:	Quantity of final sludge from UASB reactors sent to compost yard
Measured /Calculated /Default:	Measured
Source of data:	Log books, gate passes
Value(s) of monitored parameter:	1891
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emissions
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Weighbridge Make : Avery Serial Number : EB-05s/602 Calibration Frequency : Once in an year Date of last calibration : 17.06.2010 Validity : 16.06.2011 Date of previous calibration: 18.06.2009 Validity : 17.06.2010

Measuring/ Reading/ Recording frequency:	as and when generated and disposed
Calculation method (if applicable):	NA
QA/QC procedures applied:	Calibration of weighbridge been conducted once in a year by the Weight and Measurement Department of Government of Karnataka.

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

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The baseline emissions are calculated by using the formula given below:

BE_y = ($Q_{y, biogas,sent\ to\ boiler}$ * Combustión Efficiency) + ($Q_{y, biogas, flared}$ * Flare Efficiency) *

C_{CH4} * D_{CH4} * GWP_CH_4

BE_y	is baseline emissions in the year "y" (ton CO_2e)
$Q_{y, biogas,sent\ to\ boiler}$	is volume of biogas sent to boiler in the year "y" (Nm^3/year).
Combustión Efficiency	default value 1.0 (Biogas is combusted in the heating equipment)
$Q_{y, biogas, flared}$	volume of biogas flared in the year "y" (m^3/year).
Flare Efficiency	default value 0.5[3](Biogas is combusted in the open flare).
C_{CH4}	is the methane content of biogas (%) which is measured once in a month and average value is adopted[4]
D_{CH4}	is the density of methane (ton/m3) which is a default value as given in ACM0001"Consolidated baseline and monitoring methodology for landfill gas project activities"
GWP_CH_4	is the Global Warming Potential of methane (21 ton CO_2e / ton CH_4)

BE_y = (6109369 * 100%) + (301156 * 50%) * 56.26 % * 0.7168 * 21
= 58,585.4 tCO2 e

Please refer to the spreadsheet for detailed baseline emissions calculation.

E.2. Project emissions calculation

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As per AMS-III.H/ Version 04, the project activity emissions **(PE_y)** consist of :

[4] The methane content of biogas (%) has been measured every month by internationally accepted methods. In line with paragraph 11 of version 4, based on the monthly measurements, the value correspondent to the lower bound of the 95% confidence level (i.e 58.28%) has been used for the entire monitoring period. Please refer to excel sheet for detailed calculations.

(i.) CO_2 emissions on account of power used by the project activity facilities in the year "y" **($PE_{y, power}$).**

(ii.) Methane emissions through inefficiency of the wastewater treatment and presence of degradable organic carbon in treated wastewater in the year "y" ***($PE_{y,ww,treated}$).***

(iii.) Methane emissions from the decay of the final sludge generated by the treatment systems in the year "y" ***($PE_{y,s\ final}$).***

(iv.) Methane fugitive emissions through inefficiencies in capture and flare systems in the year "y" (**$PE_{y,fugitive}$.)**

(v.) Methane emissions resulting from dissolved methane in the treated wastewater effluent in the year "y" **($PE_{y, dissolved}$)**

PE_y	$=PE_{y,power}+$	$PE_{y,ww,,treated}+$	$PE_{y,s\ final}+$	$PE_{y,fugitive}$	$+$	$PE_{y, dissolved}$
(t CO_2e /year)	(t CO_2e /year)	(t CO_2e /year)	(t CO_2e /year)	(t CO_2e /year)		(t CO_2e /year)

(i) CO_2 emissions related to the power used by the equipment in the project activity **($PE_{y,power}$).**

These are the emissions due to electricity consumed by the installations in the project activity. These emissions are obtained by multiplying the electricity consumed in the year ($E_{consumed}$ MWh/ year) and the electricity baseline emission factor of the grid. (EF_y t CO_2/ MWh)

$PE_{y,power}$	=	$Ey_{, consumed}$	*	EF_y
(t CO_2e /year)		(MWh/year)		(tCO_2/MWh)

Where

$Ey_{, consumed}$ Electricity consumed in the year "y" (MWh/year)

EF_y Electricity baseline emission factor (tCO_2/MWh)

Emission Factor:

EF_y- Electricity baseline emission factor of the grid

Since the electricity baseline emission factor of the grid is applied to calculate the project activity emissions only, the higher value of table B.6.1 (0.86 t CO_2/ MWh) would be adopted.

$PE_{y,power}$	=	32.7709*	0.86
(t CO_2e /year)		(MWh/year)	(tCO_2/MWh)
	=	282.1 t CO_2 e	

(ii) Methane emissions through inefficiency of the wastewater treatment and presence of degradable organic carbon in treated wastewater ***($PE_{y,ww,treated}$).***

The project emissions due to COD in the wastewater leaving the digesters is calculated as per the following formula given in the approved methodology AMS-III.H/Version 04;

$PE_{y, ww, treated} = Q_{y, ww} * COD_{y, ww, treated} * B_{0, ww} * MCF_{ww, final} * GWP\_CH_4$

Where

$PE_{y, ww, treated}$ is the project emissions due to degradable organic carbon in the wastewater leaving the wastewater treatment in t CO_2 e/year in the year "y"

$Q_{y, ww}$ is the volume of wastewater treated in the year "y"

$COD_{y, ww, treated}$ is the chemical oxygen demand of the treated wastewater in the year "y" in ton/m^3

$B_{0, ww}$ is the methane generation capacity of the treated wastewater (as per AMS-III.H/ version 4, IPCC default value of 0.21t CH_4/t COD is adopted)

$MCF_{ww, treated}$ is the methane conversion factor based on type of treatment and discharge pathway of the wastewater. (MCF higher value in table III.H.1. shall be adopted). The wastewater after the UASB reactors would flow to anaerobic deep lagoon (depth more than 2 metres). The MCF higher value as per Table III.H.1 for anaerobic deep lagoon is **1.0**

GWP_CH_4 Global Warming Potential for CH_4 (21 ton CO_2/ton CH_4)

$PE_{y, ww, treated}$ = 170,578 ***** 0.13 * 0.21 * 1.0 * 21
= 28,290.50 t CO_2 e

(iii) Methane emissions from the decay of the final sludge generated by the treatment systems in the year "y" ***($PE_{y,s\ final}$).***

These are the emissions that arise from the anaerobic degradation of the final sludge produced by the treatment systems. In the project activity, the sludge produced by the treatment systems is very less. This sludge is basically the excess sludge in the UASB reactors which are removed from the UASB reactors periodically. In the project activity, this sludge would be mixed with pressmud and treated wastewater and subjected to aerobic composting. Since the sludge is processed through aerobic methods, the sludge would not degrade anaerobically and hence there would be no emissions.
The sludge quantity generated (**S y, generated)** and disposed **(S y, consumed)** during the verification period is detailed in the spreadsheet.

(iv) Methane fugitive emissions through inefficiencies in capture and flare systems in the year "y" **($PE_{y,fugitive}$)**

These are the emissions that would occur when biogas is combusted in flare and heating equipment.

$PE_{y,fugitive}$ = $PE_{y,fugitive,ww}$ + $PE_{y,fugitive,s}$

Where :

$PE_{y,fugitive,ww}$ is fugitive emissions through capture and flare inefficiencies in the anaerobic wastewater treatment in the year, "y' (ton CO_2e) and

$PE_{y,fugitive,s}$ is fugitive emissions through capture and flare inefficiencies in anaerobic sludge treatment in the year, "y' (ton CO_2e). .

Since the sludge is not treated anaerobically, $PE_{y, fugitive, s}$ is not calculated

Hence, **$PE_{y,fugitive}$** = **$PE_{y,fugitive,ww}$**

$PE_{y,fugitive,ww}$ = $(1-CFE_{ww})$ * $MEP_{y, ww, treatment}$ * GWP_CH_4

Where, CFE_{ww} is capture and flare efficiency of methane recovery and combustion equipment. As per the registered PDD, biogas is combusted in the heating equipment, and rest of the biogas which is not used in heating equipment is flared. A default value of 1.0 is used as combustion efficiency for heating

equipment while default value of 0.5 is used as flare efficiency. This is inline with the applicable methodology, associated tools and the registered PDD for the project activity.

$MEP_{y, ww, untreated}$ is methane emission potential of the untreated wastewater in the year "y" (tons)

GWP_CH_4 is Global Warming Potential for CH_4 (21 ton CO_2/ton CH_4)

$MEP_{y,ww, treatment}$ = $Q_{y, biogas}$ * C_{CH4} * D_{CH4}
(ton CH_4/year) (m^3/year) (%) (ton CH_4/ton COD)

Where:

$Q_{y, biogas}$ is volume of biogas generated from waste waster treatment plant in the year "y" (m^3/year). The quantity of biogas is continuously measured by flow meters and recorded in logbook for year "y"

C_{CH4} is the methane content of biogas (%) which is measured once in a month and average value is adopted

D_{CH4} is the density of methane (ton/m^3) which is a default value as given in ACM0001"Consolidated baseline and monitoring methodology for landfill gas project activities"

$PE_{y,fugitive,ww}$ = (1-0.5) * 301156 * 56.26 * 0.7168 * 21
(ton CH_4/year) (m^3/year) (%) (ton CH_4/ton COD)

= 1320.80 t CO_2 e

(v) Methane emissions resulting from dissolved methane in the treated wastewater effluent in the year "y" **(PEy, dissolved)**

These are the methane emissions due to methane dissolved in the treated wastewater which are calculated by the formula as per AMS-III.H/version 4:

$PE_{y, dissolved}$ = $Q_{y, ww}$ * $[CH_4]_{, y, ww, treated}$ * GWP_CH_4
(ton CO_2 e/year) (m^3/year) (tonnes/m^3) (ton CO_2 e /ton CH_4)

Where,

$Q_{y, ww}$ is the volume of wastewater treated in the year "y"

$[CH_4]_{, y, ww, treated}$ is the dissolved methane content in the treated wastewater. As per the methodology, default value of 10 e^{-4} tonnes/ m^3 would be adopted for estimation of ex-ante calculations.

$PE_{y, dissolved}$ = 170,570 * 10 $^{e-4}$ * 21
(ton CO_2 e/year) (m^3/year) (tonnes/m^3) (ton CO_2 e /ton CH_4)
= 358.10 t CO_2e

PE_y = $PE_{y,power}$ + $PE_{y,ww,,treated}$ + $PE_{y,s final}$ + $PE_{y,fugitive}$ + $PE_{y, dissolved}$
(t CO_2e /year) (t CO_2e /year) (t CO_2e /year) (t CO_2e /year) (t CO_2e /year) (t CO_2e /year)
= 282.10 + 28,290.50 + 0 + 1,320.80 + 358.10
= 30,251.50 t CO_2e

Please refer to the spreadsheet for detailed project emissions calculation.

E.3. Leakage calculation

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Leakage not applicable.

E.4. Emission reductions calculation / table

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The emission reduction of the project activity is the difference between the baseline emissions and the sum of the project emissions.

$$\mathbf{ER_y = BE_y - PE_y}$$

Where ER_y is the emission reductions of the project activity for the year "y" (tCO_2 e)
BE_y is the baseline emissions in the year "y" (tCO_2e)
PE_y is the project activity emissions in the year, "y' (tCO_2 e)

Total baseline emissions: 58,585.40 tCO_2 e
Total project emissions: 30,251.50 tCO_2 e
Total leakage: 0 tCO_2 e
Total emission reductions: 28,333.0 tCO_2 e (Rounddown)

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

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This section shall include a comparison of actual values of the emission reductions achieved during the monitoring period with the estimations in the registered CDM-PDD.

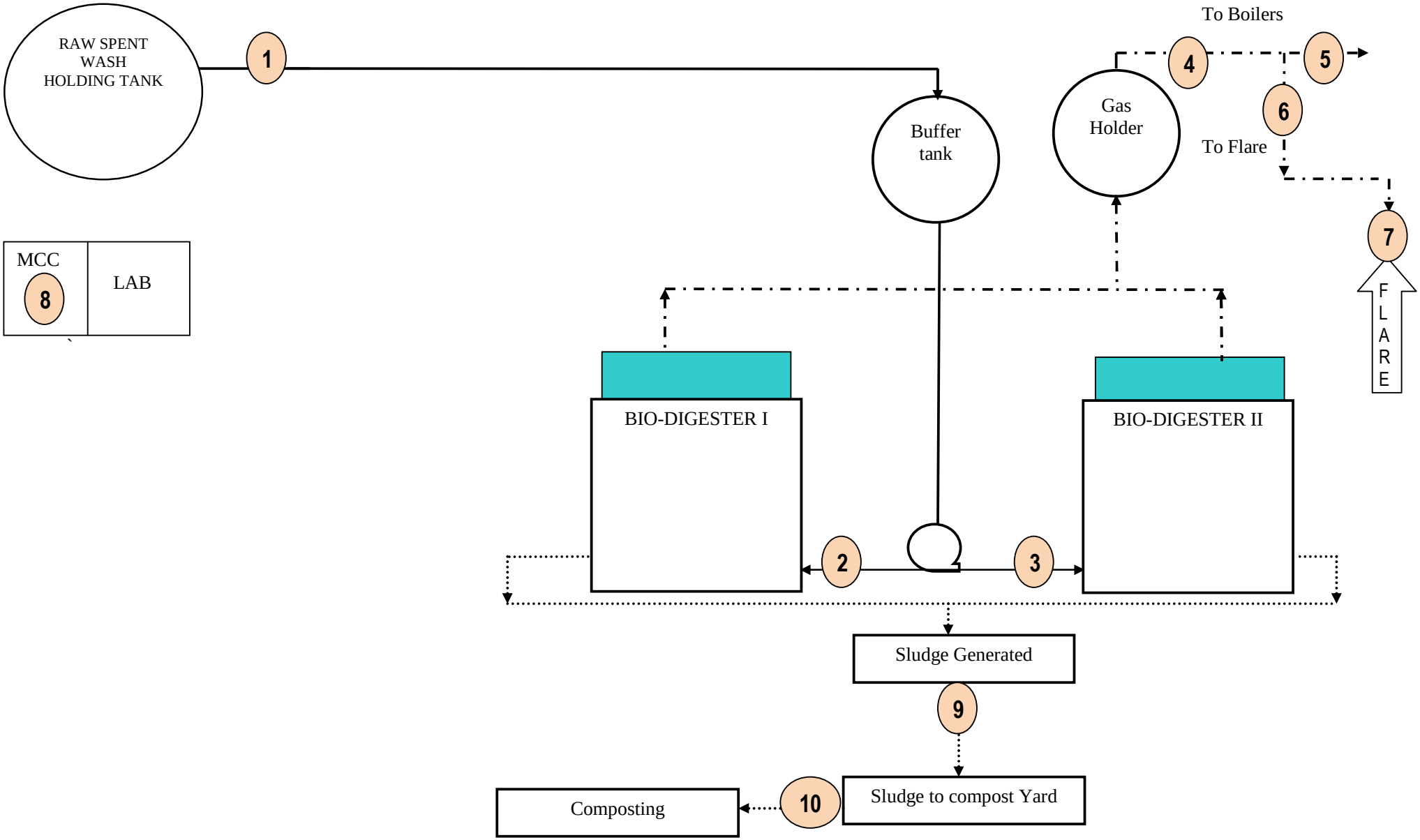
Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO_2e)	**68,848**	**28,333**

E.6. Remarks on difference from estimated value in the PDD

>>

There is no **increase** in the actual emission reductions achieved during the current monitoring period. However, there is decrease in the actual emission reduction due to less wastewater generation.

Annex-1 Line diagrams showing all relevant monitoring point



Meter details:

1 -- Flow meter measuring Volume of wastewater entering the wastewater treatment plant

2 -- Flow meter measuring waste water inlet feed to digester – I

3 --Flow meter measuring waste water inlet feed to digester – II

4 --Flow meter measuring Volume of biogas generated

5 --Flow meter measuring Volume of biogas sent to boiler

6 --Flow meter measuring Volume of biogas flared

7 --Flare temperature sensor

8 --Energy meter

9 --Weighbridge measuring sludge generated

10 --Weighbridge measuring sludge disposed

History of the document

Version	Date	Nature of revision
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory **Document Type**: Guideline, Form **Business Function**: Issuance		